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THE COST AND THE PROFITS OF STEEL-MAKING IN THE UNITED STATES.

SUMMARY.

The causes of differences in cost, as to ore, 262–264; fuel, 264–267; limestone, 267; labor cost for iron and steel, 267–270.—The accumulated profits of the Steel Corporation, 270–272.—The results of its business for 1906, 272–273.

THE figure for the cost of steel throughout the United States or any particular country is little more definite than that for building a house or hiring a servant. The situation is too complex and has too many varying elements to permit the figures to be the same for producing a ton of steel in any two places or even in the same plant from day to day. Every plant shows a variation, and sometimes these variations are far from slight.

It may seem simple: that the cost of a ton of steel is the cost of the raw material plus the cost of labor plus the capital and maintenance charges on the plant. But the raw materials may be bought in an open market or they may be made by the user. If the user makes them himself, they represent cost of production for him. If he buys them, they have no fixed relation to the cost of production, may in rare instances be below it, but usually are as much above it as the most anxious purchaser is willing to pay. These raw materials may be manufactured, again, in isolated, antiquated mills, where costs are high, or in the most efficient, most modern, and best plants, where the cost is at the minimum.

The only way to understand the cost factors and their range of variation is to examine them one by one. The most natural place to begin is with the cost of iron, the most important of the materials.

If the iron is bought,—as is yet the case with many steel mills,—the problem is simple, because the market price must be paid. This, however, is often 50 per cent. above cost price, and at times for many months together 100 per cent. or even more. It is therefore evident that no plant can afford to buy its pig iron unless it is to be used in those forms of manufacture which greatly increase its value: otherwise, it would be impossible to sell in competition with steel-makers making their own iron, and therefore getting it at cost. For example, a steel rail is a comparatively crude product, and therefore would not sell at a price as much above the cost of pig iron as would a boiler plate or a piece of good shafting. While the manufacturer of cruder products cannot buy his pig iron, the manufacturer of finer products may, and in many instances does, buy it.

If the iron is not bought, but made, there are at least five cost factors which should be noted. There are the three raw materials, ore, fuel, and flux; fourth, labor; and, last, the cost of keeping up the plant.

Let us consider the ore costs. Ore price, like that of all other commodities, may be set by either of two influences. It may be decided by what it costs to get it to the market or it may be set by the value that the product has to the purchaser, or, in other words, what he can afford to pay for it. As a matter of common practise, both of these influences are usually at work in every market, and the ore market is no exception to the rule. The operator of the most inaccessible, the poorest, or the leanest mine, must sell at a price that pays back his costs. If his ore must be had, it serves to set the price, and the same price is demanded by the lucky prospector who finds a solid bank of ore comprising a whole hillside and costing almost nothing to mine, because it is merely shovelled up. The lucky mine-owner may get rich quickly, as many of them have done, by selling his cheap ore to smelters at the ruling market price of ore. There have been times in our pushing prosperity when the pressure for ore may be said to have eliminated the marginal mine for the time being and when all were mines of profit.

Here, then, is a problem, and a very serious problem, before the smelter of iron. Shall he buy his ore in the open market and take the fluctuations as they come,—high prices with the low, glut or famine, as the case may be,—or shall he enlarge his capital and widen his enterprise by becoming his own ore producer, and thereby get it at cost? In practise blast furnaces are being supplied by both methods. It is a distinct enlargement of the enterprise and the capital, and also of the risk, to do your own mining.

It is unquestionably true that, provided the deposit be good, the cheapest possible way of buying ore is to buy the ore land. It is natural that the present trend should be towards the elimination of the independent iron miner, who sells his ore to any purchaser as a coal miner sells coal to the purchasing public. But it should not be overlooked that probably the greater *number* of smelting concerns in this country still go to the ore merchant for supplies. In quantity of output the rank is with the mining smelter's of which the towering Steel Corporation is the great and shining but by no means isolated example.

There are various compromise methods between these two extremes. It is often a difficult and expensive operation to ascertain even the approximate amount of iron in a given deposit. In bargaining for its sale, neither party knows just what is at stake, and a greater definiteness is attained by leasing the mine on the basis of its contents than selling it in lump, land and all. The bargain is usually sealed by a cash payment, but all further payments are made from time to time for the ore removed. This method plainly takes less of the furnaceman's capital, and it also gives him less risk; for he knows what he is getting, altho he commonly pays more for it than if he had bought the land outright. The owner of the mine is usually protected by contract provisions requiring the removal of stipulated amounts of ore within given periods, and in the case of the greatest of all these deals—the Great Northern ore lease to the Steel Corporation last year—there is an annual rise in the scale of prices.

There are other means of so managing the ore supply that both price fluctuations are uncertainty of supply are largely eliminated through a semi-partnership arrangement between the smelter and the miner, whereby each shares the other's prosperity and hard times. Pig iron has been so wild in its price fluctuations that one month the smelter would gladly give a price for ore that a year later would start him down the slippery road to ruin. Therefore, long-term contracts at fixed prices are hard to make. The furnaceman sees possible low prices and is afraid to bargain for high-priced ore next year or the year after. The miner sees possible high iron prices and wants to share them by getting a high ore price. The pair naturally have difficulty in bargaining on a definite rate. Hence a sliding scale has been evolved in some sections, whereby high prices in iron cause the payment of high prices for ore and *vice versa.* The remarkable way in which this semi-partnership works out into a practical profit-sharing is shown in one of these schedules, where an advance of 2½ or 5 cents per ton of ore is made for every 25 cents advance in iron price. Therefore, $10.50 iron is made from $1.15 ore, and $23 iron is made from the same ore at a cost of $2.95 per ton.

Taking all of these conditions together, there is, in the country at large, easily a difference of more than 100 per cent. in the ore cost of a ton of iron at different furnaces, the base price being that of the mining smelters.

The fuel costs respond to influences closely analogous to those that decide the cost of ore. The smelter may buy coke in the open market or he may make it for himself by either one of two processes. Here, also, as was the case in ore supply, there is no uniformity of practise; but the independent production of coke is more frequent than the independent mining of ore. Yet it is also true that the percentage of gain to be made by the private supply of coke is sometimes extraordinary. The price of coke is strictly competitive, and often, in times of scarcity, such as we have recently passed through, there is keen strife among blast-furnace men to get the fuel necessary to keep their furnaces busily pouring forth their golden stream. That stream is indeed golden when the cost of iron is $10 to $14 per ton and the price $18, $20, or $22 per ton, with a clamorous demand from the purchaser. If the coke is all that is needed to keep the plant running, the operators can well afford to bid up for the fuel, and they do so with a profound influence on prices. There have been times in the past decade when the Connellsville coke-maker exacted $8 per ton from the feverish iron smelters, who, under reversed market conditions, had induced him to part with it for $1 a ton. Last year an iron-master told me that the Steel Corporation was making coke at a cost of $1 a ton, refusing to sell it at $4 per ton, and buying more at the same price. It takes from a ton to 1⅓ ton of coke to make a ton of iron, and, with the single difference in cost arising from purchased or privately made coke, there arose at that moment a difference of $4 per ton in pig-iron cost. That difference alone is sufficient to provide for a profit which, if steadily maintained, would soon make smiling millionaires of all the iron-makers in the country.

In the early part of 1906 Connellsville coke (the standard) was quoted at $3 to $3.75 per ton. It may be made in the old-fashioned wasteful but cheaply built beehive oven at a total cost ranging from a little over $2 a ton down to the neighborhood of $1, depending on local conditions and the price of purchased or privately mined coal. On the other hand, there are iron-makers who are using the new by-product coke oven, which makes much cheaper coke than the old oven, altho the oven itself is more costly to build. In one of these coke plants with which it has been my privilege to become acquainted, the costs are about as follows:—

A ton of coke requires 1.6 tons of coal, costing at 60 cents	$0.96
Labor and supplies, repairs and depreciation	.30
Cost of operating the plant per ton of coke	$1.26

The plant produced from each ton of coal:—

Tar, gallons	8.07
Ammonia, pounds	4.18
Surplus gas, cubic feet	1,040

Receipts from the coal making each ton of coke:—

Tar, 12.91 gallons sold at 2.27 cents	29.3
Ammonia, 6.69 pounds sold at 10 cents	64.8
	94.1

Gas (not yet accounted for), 1,664 cubic feet

Without counting the gas, the first two by-products, tar and ammonia, are worth—that is, they actually sell for—94.1 cents per ton of coke, leaving the coke cost 31.9 cents per ton. The makers still have on hand one and two-thirds thousand cubic feet of gas. Just what that gas is worth it is hard to say. This particular company passes it on as a power fuel to a subsidiary industry, and charges it on the books at a ridiculously low rate. Many subsidiary industries might use it, such as a rolling mill, a glass plant, a municipal gas plant, municipal electric light or street railway, a central electric power plant, a sand quarry and mill, or a cement mill. Certainly the owners of this particular bank of coke ovens would not sell the gas to an outside user for 10 cents or 15 cents. It is probably worth 20 cents per thousand. If they sold it at the last-named rate, it could be used in a gas engine at a fuel cost of less than ½ cent per hour per horse power, and it would come to a little over 32 cents per ton of coke made. That would leave the cost of the coke exactly nothing, or possibly a mill per ton less than nothing. It could really be heaved into the blast furnace with no charge whatever for furnace fuel. Granting, however, for purposes of discussion, that it really did cost 25 cents a ton, and taking that as a base, we have a variation of much more than 1,000 per cent. in the cost of fuel to various ironmakers in the United States.

The limestone flux, which by its alkaline qualities hastens the melting process, is acquired by simpler methods; but there is yet a varying range of prices, causing some iron-makers to pay twice as much for it as others do. Not all limestone suffices, and thousands of tons of it are carried at least 200 miles, including the high climb over the Alleghanies. Deposits in the Shenandoah Valley near the Potomac River are rapidly rising in importance as a source of flux for the Pittsburg district. Some of the smelters are so situated that they can use the waste chips from marble yards and marble quarries, others operate their own quarries, while still others buy from merchant quarries; hence the 100 per cent. variation in cost.

These surprising variations in raw material costs are met by similar variations in the labor cost of a ton of iron. This is due to the great opportunity for economies that arise from the organization of labor and the elimination of idleness in large scale production. Labor that is producing most efficiently must be continuously employed. At times this is impossible at a small blast furnace, where there is a great variety of work to be done, and where there must be on hand force enough to attend to it at the rush periods. I have examined the cost sheet of a comparatively small blast furnace in which the labor charges were subdivided into fifty-two classes. This variety of work and of workers explains the impossibility of constant employment and the consequent high labor cost of the iron, which at this furnace was for a recent year $1.17 per ton. At the same time at the Pittsburg furnaces, with four times the output, the cost was about one-fourth as much. It takes just as many pieces of harness for a pony as for a heavy draft horse five times as large, and it takes just as much attention to drive him. It makes little or no difference in the wages paid the engineer of the furnace engines whether they be for a furnace of 200 tons per day or one of 600 tons per day. The man who dumps cars into the furnace, the man who operates the scales to weigh the materials, indeed many of the workers, would be almost the same. They would merely drive machines of greater force and greater burden. This is clearly shown by comparing the output of the same blast furnace, month by month for a year, with the labor cost per ton of output. If the furnace runs full, practically no more men are required than if the furnace runs but two-thirds of its maximum capacity. It is, therefore, plain why, in a particular case examined, the month of smallest production—namely, August, with 4,600 tons—had a labor cost per ton nearly 35 per cent. greater than the month of April, with an output (the maximum) 28 per cent. greater.

These are industrial facts whose profound significance has long been grasped by the great iron and steel makers. Furnaces in Pittsburg, with the 600 ton capacity as described above, have a labor cost at the furnace of 40 cents per ton, repairs at 12 cents, interest and depreciation 48 cents, leaving a total furnace cost of but $1 per ton in comparison with $2.10, as shown by the cost sheet of the smaller plant above mentioned.

The very cheap cost of blast-furnace labor just cited was partly due to the fact that the economical Pittsburg furnace did not make its pig iron into pigs, while the other furnaces, with labor costs above $1 per ton, made the pig iron into pigs for transportation to other works. A very considerable proportion of the fifty-two classes of labor cited above were employed in making moulds for the pig iron, running it into the moulds, breaking it up, piling it, handling it, and finally loading it into cars.

The disposition of the slag is also a cost factor. This waste of the furnace—a ton of it for every ton of iron, and usually more than a ton for a ton—has not only been a wasted by-product, but one which could be got rid of only at considerable cost. In the neighborhood of blast furnaces it has covered valuable land with unsightly and useless mountains, built up day by day through the steady work of highly paid laborers. These unappreciated monuments of industry are likely to be less numerous in the future, and they may even become of value. The material comprising them differs but little in its chemical composition from that required for cement. The enormously increasing demand for this dusty commodity is suggesting to iron-makers the ease with which their slag may be turned, as raw material already prepared, into the receiving door of a cement mill,—an item of cost turned into an item of profit, and conducing thereby to the final reduction of iron costs. This process is in its infancy, but it has already been begun by the iron-makers.

Considerable use has been made of slag from favorably located plants by selling it as broken stone for use in roofing and latterly as ballast for railways. The conversion of the molten stream of lava into these bits has already been accomplished for the remarkable low cost of 2 cents per ton by running the molten lava stream into a tank of water which quickly cooled it and broke it into small pieces, to be lifted thence into freight cars by endless chain conveyers.

It should not be understood that any one iron-maker is in a position to undergo all disadvantages in each of the cost factors. Most of the makers have a particular advantage in one or more factors, and are therefore able and willing to stand a disadvantage in some others. This is particularly the case with the plants that are near to good markets, which is in itself an advantage. The great makers of the Pittsburg district, of which the Steel Trust is a type, more nearly combine all the advantages than do the makers of any other districts with the exception of Birmingham, and possibly of Buffalo.

The actual cost and the book cost, as shown by the Steel Trust's books, would be very different. This great company performs its well-known combination of industrial and transportation services by means of a series of subsidiary corporations. Each of these keeps its own books and is apparently independent of all others. Therefore, the ore mining company, the lake carrying company, the railways in the ore region and from the lakes to the Pittsburg blast furnaces, and those from the various mines and coke plants, appear upon their books to be doing business in the ordinary way, and usually each one of them does business at a profit. Consequently, the costs upon the books are quite like the costs for any independent enterprise, and therefore appear to be much higher than they really are, because one company is paying high prices which make profits for another company. Finally, at the end of the year, the profits from all are handed up to the great central throne, where sit financial magnates who make up the balance sheets of the United States Steel Corporation.

Here we see the results of integration. In the old-fashioned, independent way the ore miner sold his ore and made a profit; the little railway to the upper lakes carried the ore and made a profit; the steamer on the Great Lakes carried the ore and made a profit; the railway to Pittsburg carried the ore and made a profit; the blast furnace made pig iron and sold it at a profit; the steel-maker bought iron, converted it into steel, and sold billets or blooms and beams at a profit, and these the steel mills made up into finished goods. In the same way the coal miner mined and sold at a profit to the coke-burner, who made coke and sold it at a profit to the iron-maker, to whom it was carried on a railway which also made a profit. So it was with the limestone for flux.

For the Trust all this has changed. A dollar's worth of ore passing through these various stages with a profit in each case might easily double the original dollar, and double it again merely through profits on profits. All the numerous profits go to the same pocket, or rather to the same finance committee. The original dollar's worth of ore may therefore be considered to give many profits, or it may be better to think of it as riding through its many stages accumulating surplus value to make one grand profit at the final selling to the consuming public. During the process, however, the Steel Trust's actual costs are often different from the figures on the books, which are at the various stages both cost and profit.

An Ohio Valley ore-purchasing furnace near Pittsburg secures Lake Superior ores at prices about $4 per ton. This, the normal price for a small smelter who does not own transportation facilities, is made up of a profit for the ore merchant; freight rate to the Upper Lake ports of 80 cents per ton, of which at least 50 cents is profit; a lake rate of 80 cents, also yielding a large profit; railway freight rate, again profitable, of $1.14 from the Lower Lake port to Pittsburg. The Steel Trust, with its 200 steamers and its many railways and mines, can pocket all these profits and get its ore to Pittsburg for not far from $2 per ton, or about $3 for a ton of iron. The necessary coke and limestone for a ton of iron certainly cost less than $4. Thus $7 is an adequate figure for the material cost, while the labor and maintenance charges at the furnace add but another dollar. In the mean time, with this astonishingly low cost, the prevailing price of iron for many months in 1906 and 1907 was above $20 per ton, and sometimes more. That price had to be paid by the steel-maker depending upon outside sources for his iron.

The making of iron into steel is also a process with variable costs. One of the factors affecting the variation is the condition in which the pig iron is received at the steel mill. If it is received in cold pigs, they must be melted. If it is brought a splashing liquid straight from the blast furnace to the converter, there is a saving of $1.50, which would have been spent in making pigs and again melting them.

Less than three years ago, the cost of conversion from pig iron to steel in Pittsburg was from $3 to $3.50. Increased labor costs have now brought it up to a point where $4 is probably an outside figure. In some parts of the country the cost rises to $7 per ton for plants of less efficient construction, equipment, and operation. That brings the cost of the Pittsburg ingot up to about $12.

The rolling of rails from ingots costs $2 to $6 per ton in modern and antiquated mills, respectively. The plant of a modern rail mill costs about a million and a half of dollars. It will daily convert a thousand tons of ingots into steel rails, which, therefore, have a total cost at Pittsburg of about $14 or possibly $15. It is thus seen why the Steel Trust could sell for $16 a ton if it had to, as for a long time the rail-makers did, and also why it can easily afford to maintain a steady price at $28 per ton on steel rails and resist the temptation to demand—what during certain periods might have been easily got—a much higher price. It is plain that, if it could maintain conditions, cost remaining the same and the demand for rails clamorous at $28 per ton and sometimes more for prompt delivery, its future is more assured than that of autocrats who command what they will from a diligent and servile populace. Of course no one expected such demand to be permanent.

An examination of the year's business, as shown by the report of 1906, is certainly reassuring to the stockholders, and it should be of more than passing interest to the consumer and student. The Steel Corporation manufactured 13,511,149 tons of steel ingots, paid out a total of 147 million dollars in wages, and took 156 million dollars of net earnings. Every ton of this steel, therefore, contributed nearly $12 to net earnings. This figure is very close to the difference ($14) as calculated above between the cost and selling price of steel rails. The shrinkage of the metal in working makes the figures come even closer. The 156 million dollars of net earnings were distributed approximately as follows: dividends, 35.4 millions; sinking funds and replacements, 30.6; bonds, interest, and sinking funds, 27.7; new construction, 28.5; new plant at Gary, 21.5; surplus, 12.7,—and all of this from thirteen and a half million tons.

The company is apparently getting the future profits that were counted upon by the promoters when they so tremendously over-capitalized it at its formation. It is growing up to the capital. Just how much was that over-capitalization is a matter to which others have devoted considerable attention and with which this paper is not directly concerned.

In the depression in which we now (mid-December, 1907) find ourselves, we shall apparently have the opportunity to witness some of the effects of combination. One of the first moves was the strengthening of the Trust's position by the absorption of the Tennessee Coal Iron & Railroad Company. This occurred on November 6, 1907, after the Trust had surprised Wall Street by showing that the third quarter of 1907 had been one of the best in its history. The first nine months of this year showed net earnings of 128.4 millions as compared with 114.8 in 1906 and 84.5 in 1905.

During the year 1906 the average number of employees was 202,457. The Bulletin of the American Iron and Steel Association for December 1, 1907, reported that the Trust had recently laid off 20,000 men, and was then operating from 70–75 per cent. of its maximum capacity. By December 12 less than 50 per cent. of the corporation's furnaces were in operation. Just four years ago there was a similar depression, and only 20 per cent. of the furnace capacity was active. During the present decline in production the price of pig iron dropped a little, but not in proportion to the output. The Steel Corporation has the 51 furnaces out and 6 banked (December 12), as a part of its general policy of maintaining prices. The pig iron price and the steel price should not be confused. There is a much more open market for pig iron than for steel. There has been no reduction in steel prices. This is by far the most unusual part of the whole situation. Just as the Trust had declined to let prices soar, so now, when competition might and normally would send them to the very ground, they are held at the same highly profitable price.

If these conditions continue, the Trust will of course lose something. There is less business done, and what is done costs somewhat more because of the idle capital represented by partially unemployed plant. But, when one considers the exceedingly profitable basis of operations ascribed above and the big bargain it got in Tennessee, the Trust, while a loser, can scarcely be called a sufferer.

J. Russell Smith.